

JAN 18 2000

TECHNICAL MEMORANDUM

Environmental Cleanup Office

CH2MHILL

Milo Creek Piezometer Installation Bunker Hill Mine Water Management

PREPARED FOR: Mary Kay Voytilla/USEPA

PREPARED BY: Robert Martin/SPK

DATE: January 13, 2000

Introduction

Background

This technical memorandum documents the installation of eight groundwater piezometers constructed in the Milo Creek drainage, Kellogg, Idaho (Figure 1) during November and December, 1999. This work was conducted as part of the Bunker Hill Mine Water Management RI/FS. The piezometers were installed on the west and main forks of Milo Creek (Figure 2) and included both shallow and deep completions at four separate locations, two on each fork of Milo Creek.

Purpose and Scope

The purpose of this work was to install a data collection system consisting of groundwater observation piezometers to aid in the determination of groundwater/surface water interactions between the fractured rock aquifer system and Milo Creek. The piezometer system will be used to aid in the determination of vertical gradients, similar to a system previously installed on the south fork of Milo Creek and discussed in the report "Analysis of Recharge to an Underground Lead-Zinc Mine, Coeur d'Alene Mining District, Idaho" by Joel Hunt, October, 1984. The water level data provided by the piezometers will help to establish the zone of recharge to the mine workings. This information will help develop and determine the possible effectiveness of various infiltration mitigations. The scope of work included the following:

1. Rock borings, drilling observations, and logging of subsurface conditions.
2. Installation of a shallow piezometer at each location to measure shallow groundwater conditions.
3. Installation of a deep piezometer at each location to measure deeper groundwater conditions.
4. Completion of piezometers for future installation of instrumentation to measure and record groundwater level fluctuations.

147844

USEPA SF



1125033

Site Selection Rationale

Two piezometer sites were located on the west fork of Milo Creek and two on the main fork of Milo Creek. Preliminary piezometer site locations were originally suggested by Dr. Dale Ralston in letters dated October 5 and 26, 1999 as part of a monitoring plan for Milo Creek and after a site visit. Specific site locations were modified due to field conditions encountered during access construction and drilling operations. The following provides the rationale for each location:

Piezometer cluster WF-1 is located on the west fork of Milo Creek, topographically higher and assumed up-gradient of a local bedrock structural feature, the Katherine Fault. The cluster WF-1 site was located approximately 200 feet southwest of the inferred location of the Katherine Fault to provide the following data;

- Hydrogeologic significance of the Katherine Fault
- Measure the southern extent of the cone of depression created by the mine
- Groundwater elevations to aid in determination of stream/groundwater interactions
- Groundwater vertical gradient in this area.

Piezometer cluster WF-2 is located on the west fork of Milo Creek, topographically lower and assumed down-gradient of both the Katherine Fault and piezometer cluster WF-1. The cluster WF-2 was located approximately 25 feet northeast of the Katherine Fault to provide the following data;

- Hydrogeologic significance of the Katherine Fault for comparison with WF-1 data
- Measure the extent of the cone of depression created by the mine
- Groundwater elevations to aid in determination of stream/groundwater interaction
- Groundwater vertical gradient in this area.

Piezometer cluster MF-1 is located on the main fork of Milo Creek, topographically higher and up-gradient of the surface water diversion dam, recently constructed in Milo Creek. The cluster MF-1 was located approximately 300 feet southeast of the control structure to provide the following data;

- Measure the extent of the cone of depression created by the mine
- Groundwater elevations to aid in determination of stream/groundwater interaction
- Groundwater vertical gradient in this area.

Piezometer cluster MF-2 is located on the main fork of Milo Creek, topographically higher and up-gradient of piezometer cluster MF-1. The cluster MF-2 was located approximately 600 feet southeast of cluster MF-1 to provide the following data;

- Measure the extent of the cone of depression created by the mine
- Groundwater elevations to aid in determination of stream/groundwater interaction
- Groundwater vertical gradient in this area and for comparison with cluster MF-1.

Field Methods

Rock Borings

A field program consisting of four separate locations was conducted along the west and main forks of Milo Creek. Two piezometers, one less than 100 feet deep and the other deeper than 100 feet deep, were installed at each location. The piezometers were installed from November 8 to December 9, 1999 by Kettle Drilling, Inc. of Rathdrum, Idaho. The rock borings were advanced utilizing a track-mounted MPE 1000 drill rig equipped with reverse circulation and a downhole air hammer. A CH2M HILL geologist was onsite during the drilling and well installation activities and collected drilling information including cuttings lithology, drill rate, evidence of fracturing, and groundwater occurrence. The geologist also determined the screen interval for piezometer installation with consultation with Dr. Dale Ralston.

The total depth of each boring was determined by an assessment of the presence of fracturing, groundwater occurrence, and depth of interest to measure the vertical gradient at the location. Final depths ranged from 43 to 196 feet below ground surface (bgs). Cuttings were retrieved via a 6-inch discharge hose and described using the Unified Soil Classification System (ASTM D2488 and USBR 5005 Appendix X2 for use with crushed rock).

Piezometer Installation

One piezometer was installed in each of the eight borings. The piezometers were installed in the following order; WF-1A and WF-1B located the farthest south on the west fork of Milo Creek, WF-2A and WF-2B located north of the Katherine Fault (projected) on the west fork of Milo Creek, MF-1A and MF-1B located up-drainage from the existing control diversion dam adjacent to the Sullivan #2 Portal, and MF-2A and MR-2B located approximately 500 feet up-drainage from piezometers MF-1A and MF-1B (see Figure 2).

The piezometers were installed in approximately 5-inch boreholes. Each piezometer was constructed with 10 feet of 2-inch-diameter schedule 40 PVC manufacturer slotted screen with a slot size of 0.010 inch. Appendix A contains a piezometer completion diagram for each piezometer. Appendix B contains photos showing the piezometers during construction. The bottom of the screened casing was capped with a PVC threaded well point end cap. Blank casing consisting of 2-inch diameter schedule 40 PVC, was installed from the screen to above the ground surface. A filter sand, 10 x 20 Colorado silica sand, was installed in the annular space between the borehole and the screen with a variable thickness of sand below and above the screened interval (see Table 1 and Appendix A). The annular space between the well casing and the borehole was sealed to approximate ground surface using 3/8-inch bentonite chips. The well head of each piezometer was completed with an approximately 6-inch-diameter steel protective casing extending above the PVC casing, equipped with a lockable expansion cap.

Piezometer locations, ground surface elevations, and top of casing elevations were surveyed after completion of the piezometers by Meckel Engineering and Surveys, Inc. of Coeur d'Alene, Idaho.

Site Geology and Hydrogeology

The St. Regis Formation and Revett Quartzite of the Precambrian Belt Series are exposed within the Milo Creek watershed. The piezometers were located within the Revett Quartzite in both the west and main forks of Milo Creek. The Katherine Fault is mapped, northwest-southeast trending, intersecting the west fork of Milo Creek between piezometer locations. The location of the Katherine Fault is considered an important feature because of the possible structural control of the fractures in the Revett Quartzite due to localized faulting and the possible leakage of water through the fractures and into the mine workings. However, the precise location of the Katherine Fault is not definitive in the west fork drainage. Thus its location as shown on Figure 2 is approximate and is based on Hobbs, et al., 1965.

Milo Creek is a perennial stream which drains the watershed to the south of the investigation area. The area is underlain by crystalline rock of the Belt Series with low permeability. Groundwater is limited to alluvium in the stream channels and fractured zones in the bedrock. The stream channels are narrow and relatively steep, with relatively thin, believed to be less than 10 feet thick, alluvium in most areas. Deposits of alluvial material were encountered along the stream channel ranging from 4 to 41 feet thick.

Installation Summary

The results of the piezometer installation are summarized in Table 1, including total boring depth, screen and filter sand intervals, measured water level in each piezometer, and corresponding water level elevation as determined from the results of the survey.

West Fork Piezometers

Piezometer WF-1A is a shallow completion with a total borehole depth of 93 feet bgs. WF-1A was screened from 82 to 92 feet bgs with a sand filter pack from 93 to 76 feet bgs. Depth to water in this piezometer appeared to stabilize at 94.63 feet bgs, approximately 0.62 feet above the measured piezometer bottom.

Piezometer WF-1B is a deep completion with a total borehole depth of 195 feet bgs. WF-1B was sealed from 170 to 195 to provide a discrete observation interval of screen from 155 to 165 feet bgs with a sand filter pack from 149 to 170 feet bgs. This piezometer was dry at the time of installation, however the screened interval was placed in a fracture zone that may respond to seasonal recharge and groundwater fluctuations.

Piezometer WF-2A is a shallow completion with a total borehole depth of 97 feet bgs. WF-2A was sealed from 72 to 97 feet bgs to provide a discrete observation interval in an area of fractured rock with screen from 57 to 67 feet bgs and sand from 50 to 72 feet bgs. This piezometer was dry at the time of installation, however the screened interval was placed in a fracture zone that may respond to seasonal recharge and groundwater fluctuations.

TABLE 1
Piezometer Construction

Piezo. No.	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	TOC PVC Stickup (ft)	Screened Interval (ft bgs)	Sand Interval (ft bgs)	Water Level (TOC) (ft bgs)	Water Level Date	Reference Elevation TOC (+ ft msl)	Water Level Elevation (+ft msl)
WF-1A	93	41	3.46	82-92	76-93	94.57	11/15/1999	3987.67	3889.64
						94.59	11/16/1999	3987.67	3889.62
						94.61	11/17/1999	3987.67	3889.6
						94.66	11/21/1999	3987.67	3889.55
						94.63	11/24/1999	3987.67	3889.58
WF-1B	196	25	3.75	155-165	149-170	dry	11/17/1999	3979.82	n/a
						dry	11/21/1999	3979.82	n/a
						dry	11/24/1999	3979.82	n/a
WF-2A	97	22	3.4	57-67	50-72	dry	11/24/1999	3883.38	n/a
WF-2B	196	23	3.45	135-145	130-150	dry	11/24/1999	3885.96	n/a
MF-1A	43	4	0	30-40	21-43	17.35	12/03/1999	3422.44	3405.09
						17.35	12/06/1999	3422.44	3405.09
MF-1B	159	4	3.1	149-159	138-159	154.5	12/03/1999	3420.28	3262.68
						155.53	12/06/1999	3420.28	3261.65
MF-2A	109	33	3.67	94-104	109-90	81.5	12/07/1999	3573.96	3488.79
						84.7	12/09/1999	3573.96	3485.59
MF-2B	142	34	2.67	132-142	128-142	100.8	12/09/1999	3569.52	3466.05

Piezometer WF-2B is a deep completion with a total borehole depth of 196 feet bgs. WF-2B was sealed from 150 to 196 feet bgs to provide a discrete observation interval in an area of fractured rock with screen from 135 to 145 feet bgs with sand from 130 to 150 feet bgs. This piezometer was dry at the time of installation, however the screened interval was placed in a fracture zone that may respond to seasonal recharge and groundwater fluctuations.

Main Fork Piezometers

Piezometer MF-1A is a shallow completion with a total borehole depth of 43 feet bgs. MF-1A was screened from 30 to 40 feet bgs with a sand interval from 21 to 43 feet bgs. Groundwater was measured at a depth of 17.35 feet from top of casing (TOC) in piezometer MF-1A after construction.

Piezometer MF-1B is a deep completion with a total borehole depth of 159 feet bgs. MF-1B was screened from 149 to 159 feet bgs with a sand interval from 138 to 159 feet bgs. Groundwater was measured at a depth of 155.53 feet TOC, 138.18 feet lower than measured in MF-1A, the adjacent and shallower piezometer.

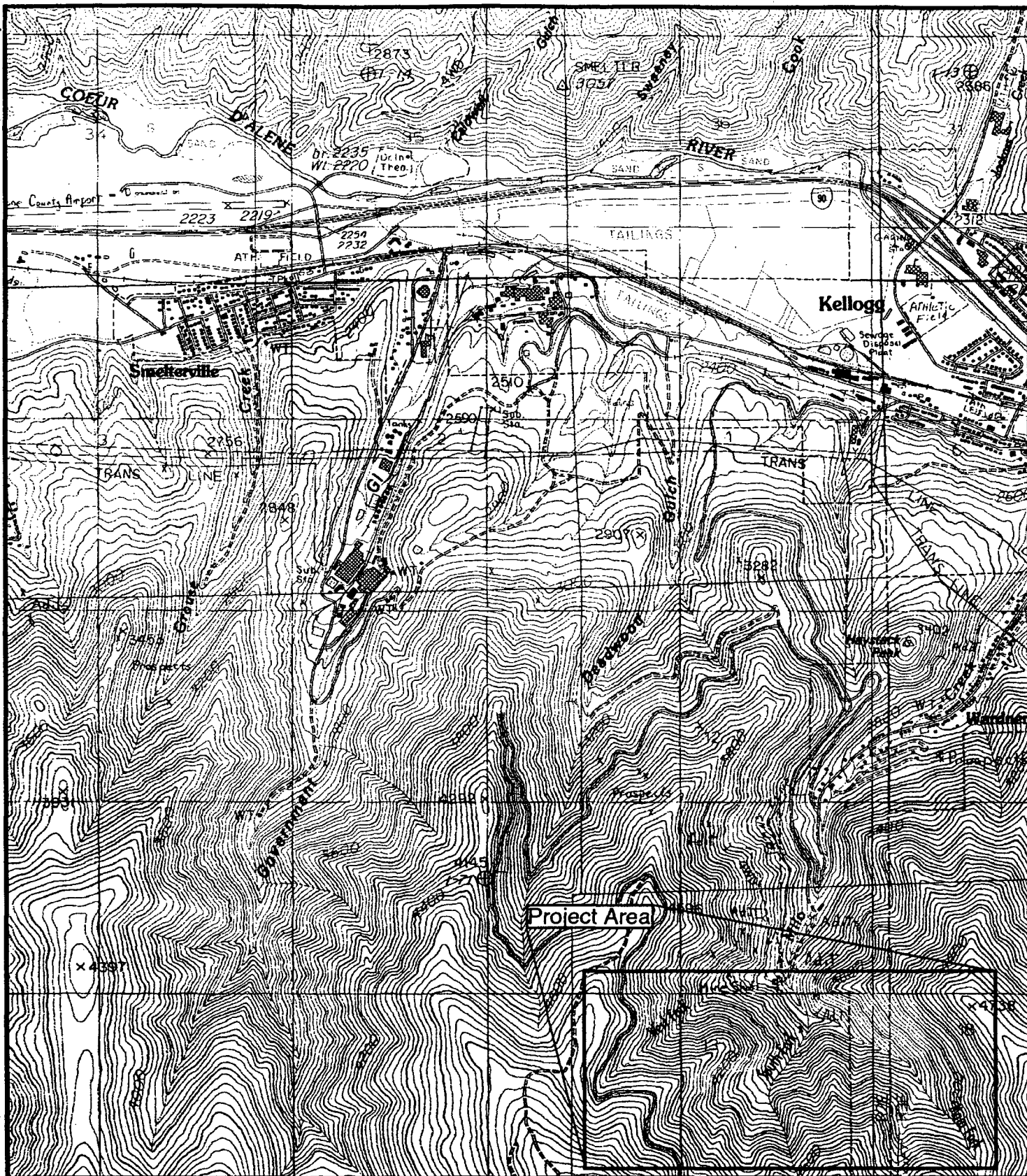
Piezometer MF-2A is a shallow completion with a total borehole depth of 109 feet bgs. MF-2A was screened from 94 to 104 feet bgs with a sand interval from 90 to 109 feet bgs to include a water bearing, quartz rich zone located at approximately 90 to 100 feet bgs. Groundwater was measured at a depth of 84.7 feet TOC in piezometer MF-2A after construction.

Piezometer MF-2B is a deep completion with a total borehole depth of 142 feet bgs. MF-2B was screened from 132 to 142 with a sand interval from 128 to 142 feet bgs to include a water bearing, quartz rich zone located at approximately 132 to 142 feet bgs. Groundwater was measured at a depth of 100.80 feet, 16.1 feet lower than measured in the adjacent and shallower piezometer MF-2B.

Conclusions

Preliminary water level measurements have indicated vertical differences in static water levels between shallow and deep completions on the main fork of Milo Creek, indicating a downward gradient. Piezometers installed along the west fork of Milo Creek were dry at the time of installation. However, observations in these piezometers resulting in either a measurement of groundwater response or lack of response to seasonal recharge will be useful in determination of surface/ground water interactions along the west fork of Milo Creek. Water level measurement and recording equipment will be installed in each piezometer for long-term data collection.

Figures



Source: U.S.G.S. 7.5 Minute Topographic Map, West Kellogg, Idaho Quadrangle, Provisional Edition 1985

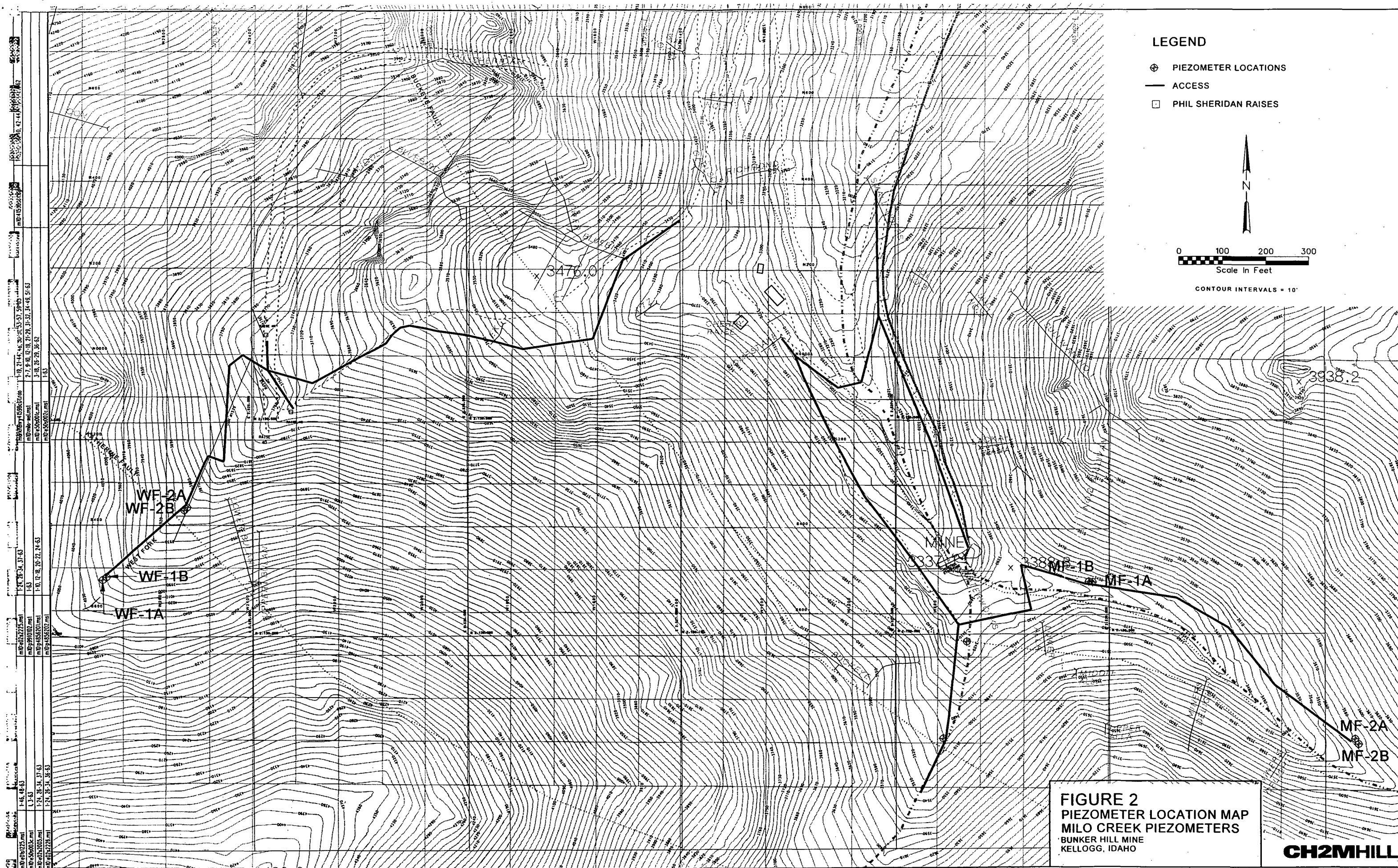


Scale 1" = 2700 feet
 0 1-inch 2700 feet

Figure 1
Project Location Map

Milo Creek Piezometers
 Bunker Hill Mine
 Kellogg, ID





LEGEND

- ⊕ PIEZOMETER LOCATIONS
- ACCESS
- PHIL SHERIDAN RAISES

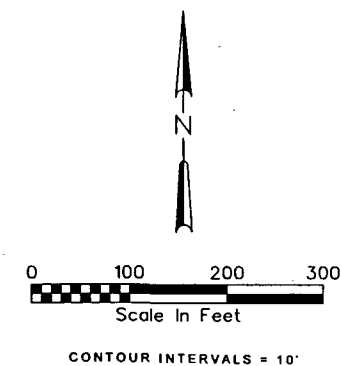


FIGURE 2
PIEZOMETER LOCATION MAP
MILO CREEK PIEZOMETERS
BUNKER HILL MINE
KELLOGG, IDAHO

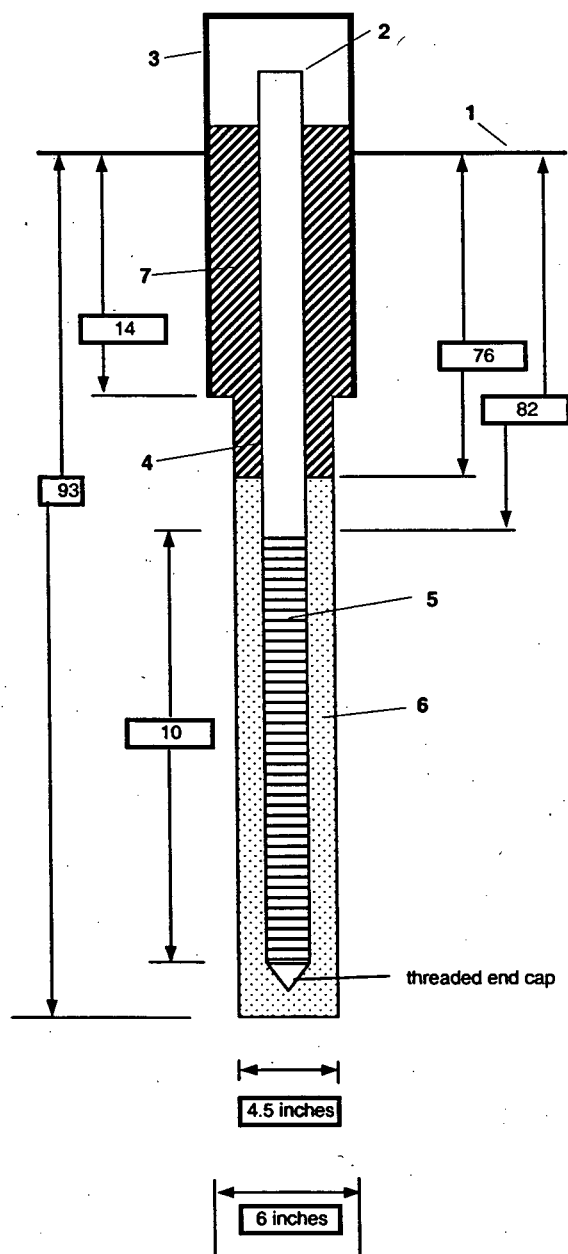
CH2MHILL

Appendix A

Piezometer Completion Diagrams

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation	WELL LOCATION : West Fork of Milo Creek, approx. 600 ft updrainage
DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)	from the Phil Sheridan raises
DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig	
STATIC WATER LEVEL AND DATE: 3889.58 11/24/99	START : 11/08/1999 END : 11/12/99 LOGGER : M. Henry & R. Martin



- | | |
|--|---|
| 1- Ground elevation at well | 3984.21 |
| 2- Top of casing elevation | 3987.67 |
| PVC stickup above ground | 3.46 |
| 3- Wellhead protection / surface casing type | 6-inch ID steel casing with lockable watertight seal |
| 4- Dia./type of well casing | 2-inch Schedule 40 PVC |
| 5- Type/slot size of screen | 2-inch Schedule 40 PVC
0.010-inch (10 slot) factory-milled slots |
| 6- Type screen filter | #10 - 20 colorado silica sand |
| a) Quantity used | 2 100# bags |
| 7- Upper annular seal type | 3/8-inch bentonite chips |
| a) Quantity used | 12 50# bags |

Generalized geology:

0 - 41	Unconsolidated talus soils
41 - 93	Revett Formation quartzite
90 and 93	Possible fractures

Comments

**CH2MHILL**

PROJECT NUMBER

152215.FI.04

WELL NUMBER

WF-1B

SHEET 1 OF 1

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation

WELL LOCATION : West Fork of Milo Creek, approx. 600 ft updrainage

DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)

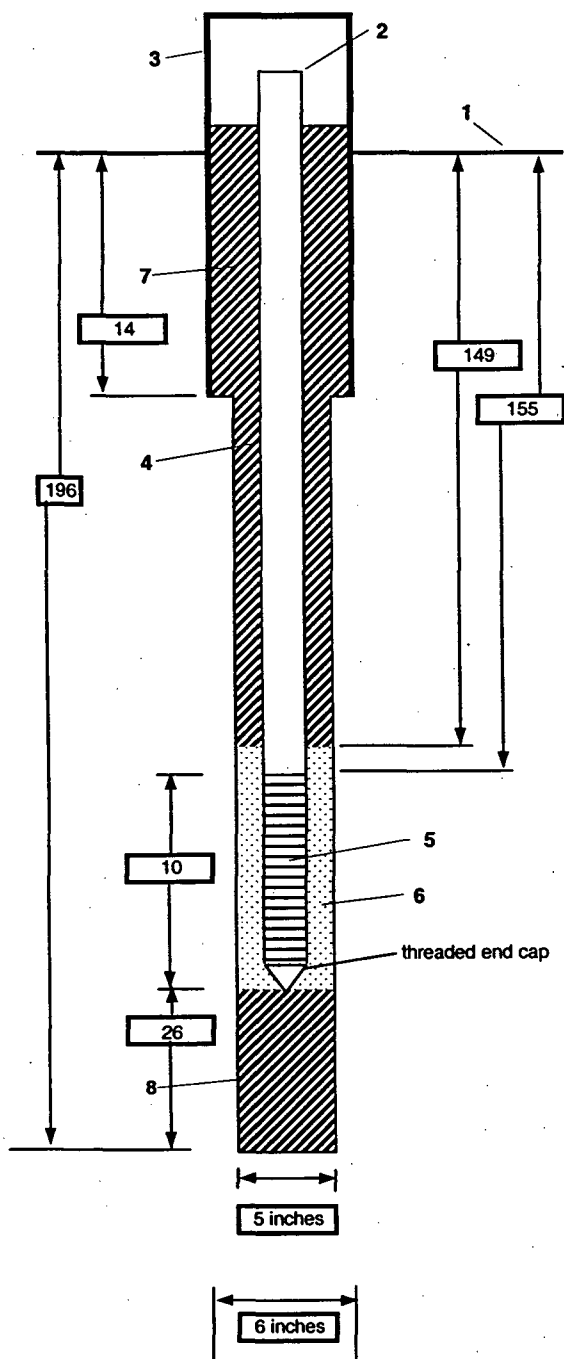
from the Phil Sheridan raises

DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig

STATIC WATER LEVEL AND DATE: Dry 11/24/99

START : 11/12/1999 END : 11/16/99

LOGGER : M. Henry & R. Martin



**CH2MHILL**

PROJECT NUMBER

152215.FI.04

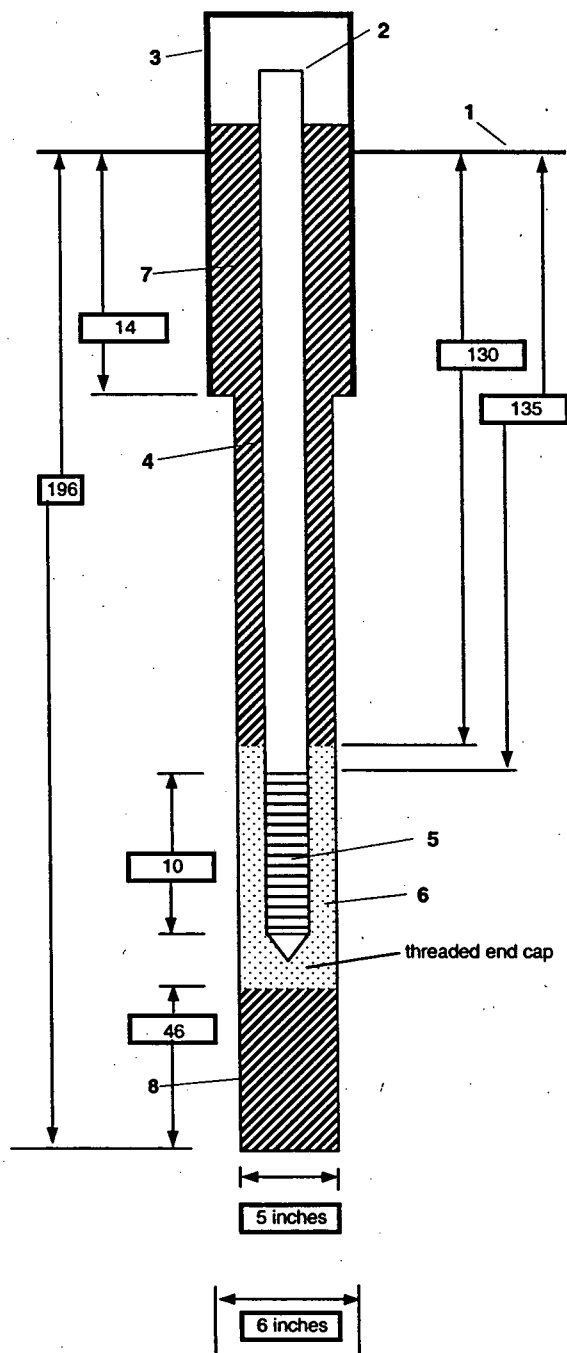
WELL NUMBER

WF-2B

SHEET 1 OF 1

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation WELL LOCATION : West Fork of Milo Creek, approx. 350 ft updrainage
DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID) from the Phil Sheridan raises
DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig
STATIC WATER LEVEL AND DATE: Dry - 11/24/99 START: 11/17/1999 END: 11/19/99 LOGGER: M. Henry & R. Martin



1- Ground elevation at well	3882.51
2- Top of casing elevation	3885.96
PVC pickup above ground	3.45
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	4 - 50# bags
7- Upper annular seal type	3/8-inch bentonite chips
a) Quantity used	25 - 50# bags
8- Lower borehole seal type	3/8-inch bentonite chips
a) Quantity used	9 - 50# bags

Generalized geology:

0 - 23	Unconsolidated talus soils
23 - 196	Revelt Formation quartzite
97 - 99	Possible fractures
102 - 104	Possible fractures
124 - 128	Possible fractures
145 - 149	Possible fractures

Comments



CH2MHILL

PROJECT NUMBER

152215.FI.04

WELL NUMBER

WF-2A

SHEET 1 OF 1

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation

WELL LOCATION : West Fork of Milo Creek, approx. 350 ft updrainage

DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)

from the Phil Sheridan raises

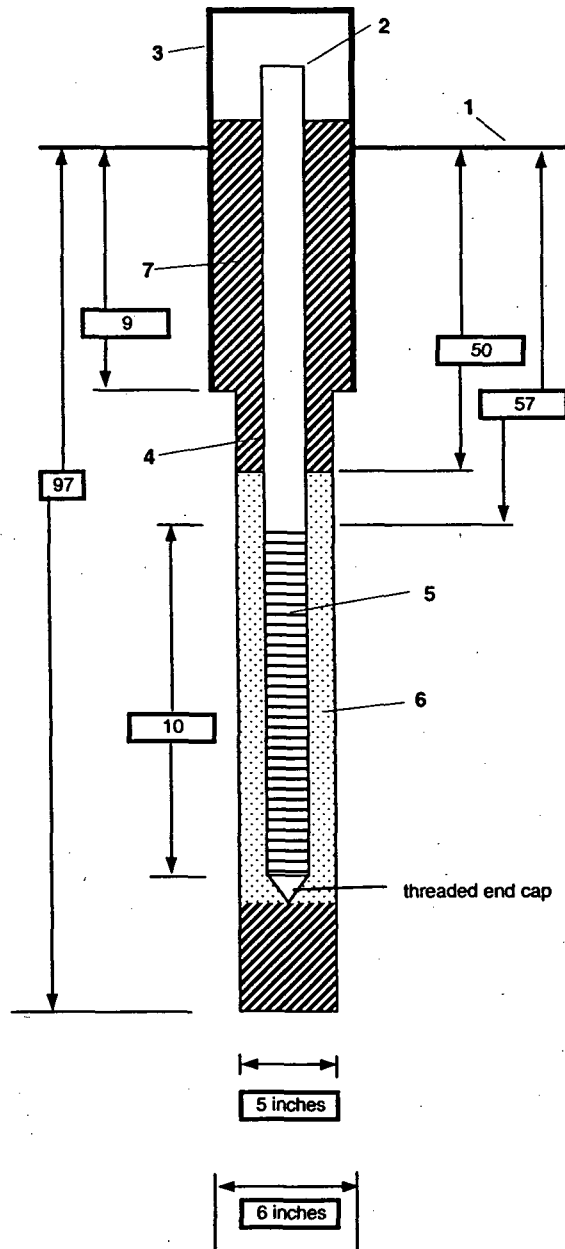
DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig

STATIC WATER LEVEL AND DATE: Dry - 11/24/99

START : 11/19/99

END : 11/24/99

LOGGER : M. Henry & R. Martin



1- Ground elevation at well	3879.98
2- Top of casing elevation	3883.38
PVC stickup above ground	3.4
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	3 - 100# bags
7- Annular seal type	3/8-inch bentonite chips
a) Quantity used	18 - 50# bags

Generalized geology:

0 - 22 Unconsolidated talus soils

22 - 97 Revett Formation quartzite

44 - 47 Possible fractures

58 - 66 Possible fractures

Comments



PROJECT NUMBER
152215.FI.04

WELL NUMBER
MF-1A

SHEET 1 OF 1

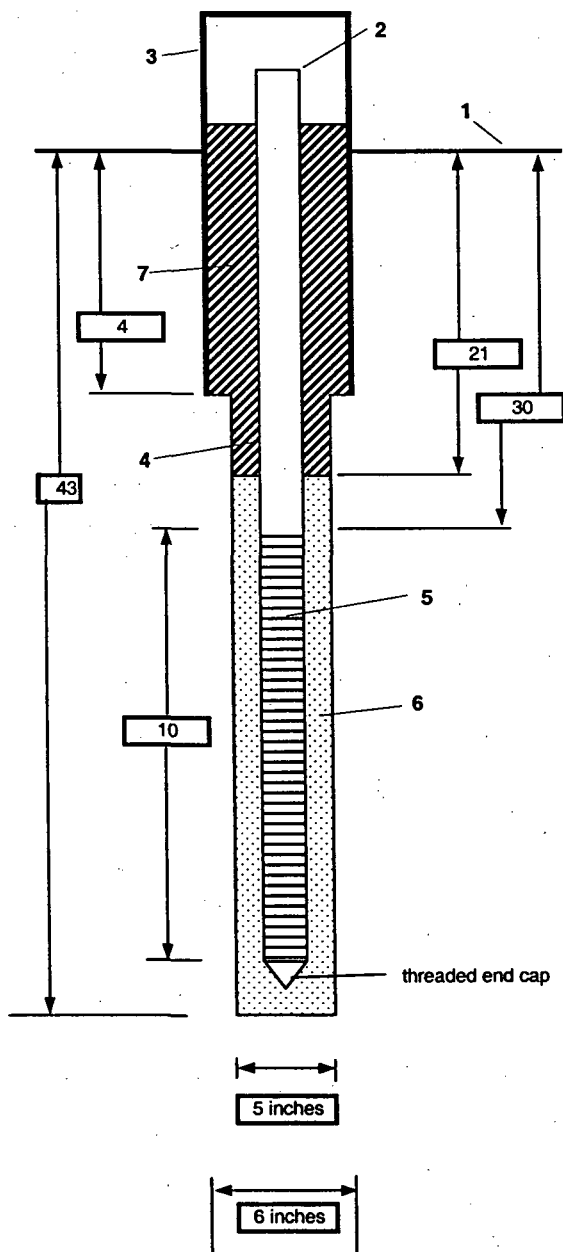
PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation WELL LOCATION : Main Fork of Milo Creek, near Sullivan #2 Portal

DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)

DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig

STATIC WATER LEVEL AND DATE: 3405.09 12/6/99 START : 12/01/1999 END : 12/2/99 LOGGER : M. Henry & R. Martin



1- Ground elevation at well	3419.12
2- Top of casing elevation	3422.44
PVC stickup above ground	3.32
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	6 - 50# bags
7- Upper annular seal type	3/8-inch bentonite chips
a) Quantity used	4 - 50# bags

Generalized geology:

0 - 4	Unconsolidated talus soils
4 - 43	Revelt Formation quartzite
40 - 44	Possible fractures, cuttings wet

Comments



PROJECT NUMBER
152215.FI.04

WELL NUMBER
MF-1B

SHEET 1 OF 1

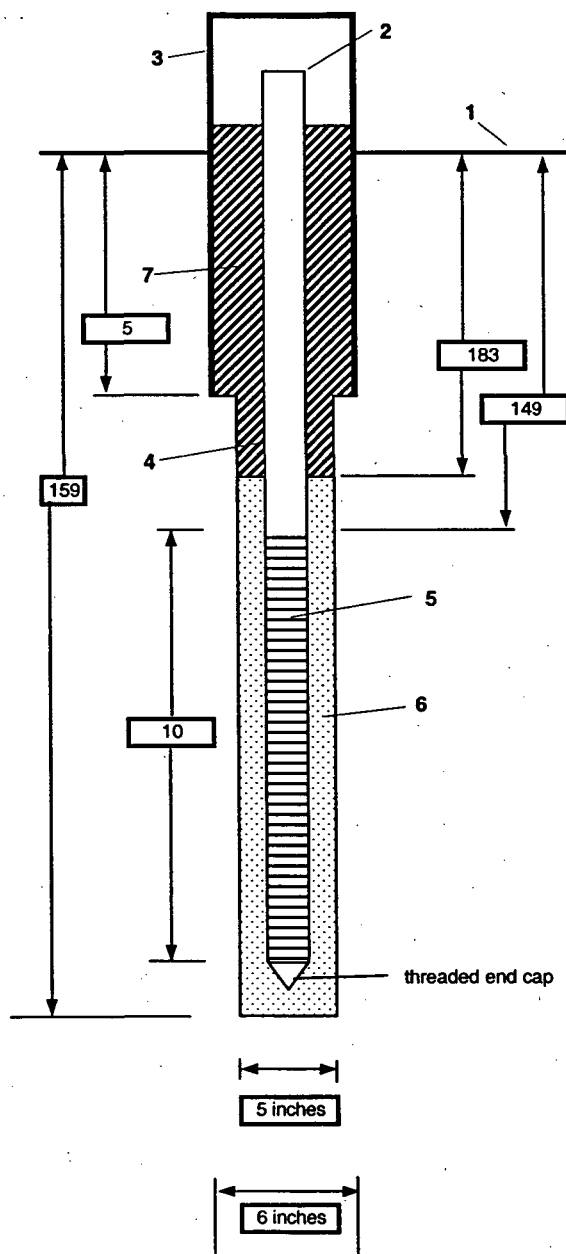
PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation WELL LOCATION : Main Fork of Milo Creek, near Sullivan #2 Portal

DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)

DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig

STATIC WATER LEVEL AND DATE: 3261.65 12/6/99 START : 11/30/1999 END : 12/1/99 LOGGER : M. Henry & R. Martin



1- Ground elevation at well	3416.82
2- Top of casing elevation	3420.28
PVC stickup above ground	3.46
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	4 - 50# bags
7- Upper annular seal type	3/8-inch bentonite chips
a) Quantity used	25 - 50# bags

Generalized geology:

0 - 4	Unconsolidated talus soils
4 - 159	Revett Formation quartzite
53 - 54	Wet cuttings
110	Possible fractures
149 - 151	Possible fractures, cuttings wet

Comments _____



CH2MHILL

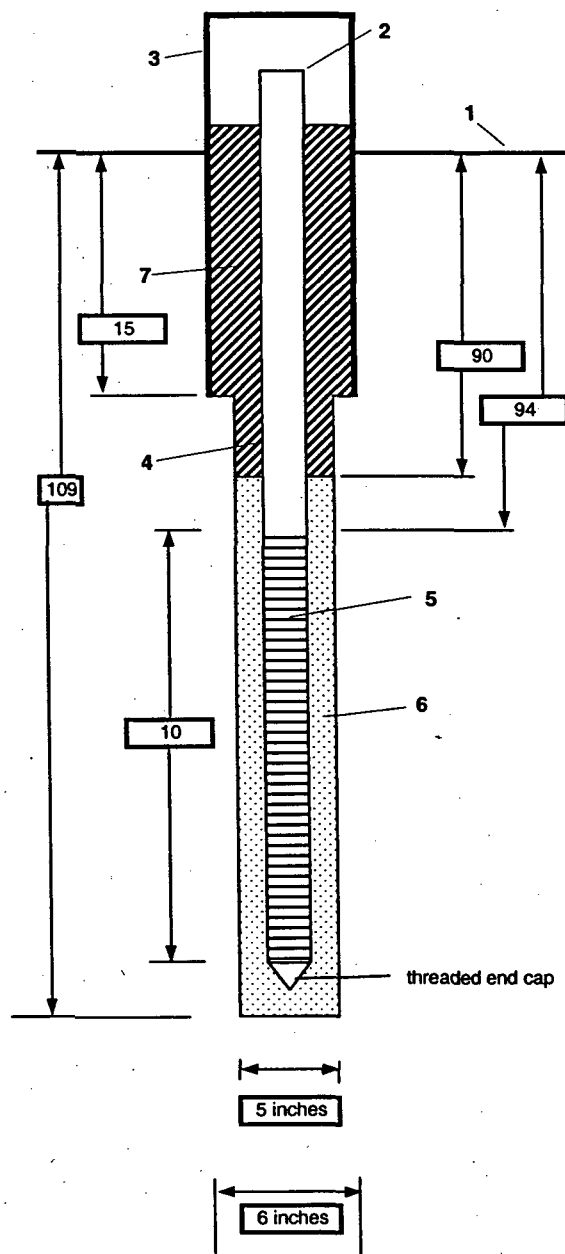
PROJECT NUMBER
152215.FI.04

WELL NUMBER
MF-2A

SHEET 1 OF 1

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation WELL LOCATION : Main Fork of Milo Creek, approx. 500 upstream of Sullivan #2 Portal
DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)
DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig
STATIC WATER LEVEL AND DATE: START : 12/3/1999 END : 12/7/99 LOGGER : M. Henry & R. Martin



1- Ground elevation at well	3570.29
2- Top of casing elevation	3573.96
PVC stickup above ground	3.67
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	10 - 50# bags
7- Upper annular seal type	3/8-inch bentonite chips
a) Quantity used	22 - 50# bags

Generalized geology:

0 - 33	Unconsolidated talus soils
33 - 109	Revett Formation quartzite
74 - 80	Possible fractures, cuttings moist
90 - 94	Possible fractures, cuttings wet 1-2 gpm discharge
94 - 100	Evidence of veining, vugs, crystals, cuttings wet
100 - 104	Hard quartzite

Comments



CH2MHILL

PROJECT NUMBER

152215.FI.04

WELL NUMBER

MF-2B

SHEET 1 OF 1

PIEZOMETER COMPLETION DIAGRAM

PROJECT : Milo Creek Mine Water Recharge Investigation

WELL LOCATION : Main Fork of Milo Creek, approx. 500 upstream of

DRILLING CONTRACTOR : Kettle Drilling, Inc (Rathdrum ID)

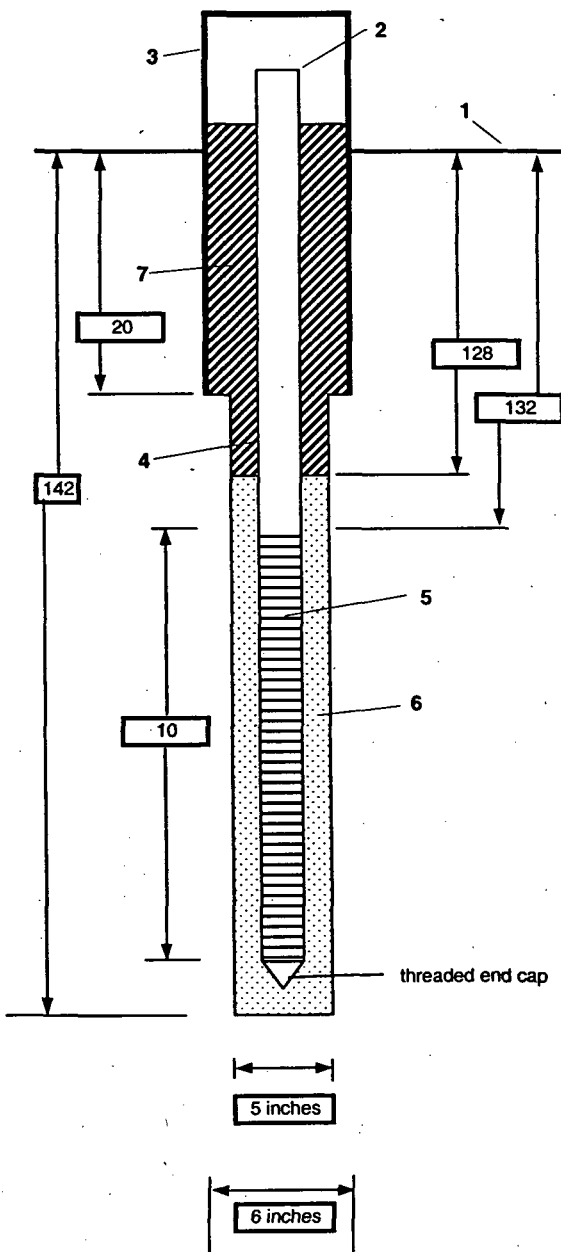
Sullivan #2 Portal

DRILLING METHOD AND EQUIPMENT USED : Reverse circulation, downhole air hammer with MPE 1000 track-mounted rig

STATIC WATER LEVEL AND DATE: 3466.05 12/9/99

START : 12/07/1999 END : 12/9/99

LOGGER: R. Martin & C. Gruenfelder



1- Ground elevation at well	3566.85
2- Top of casing elevation	3569.52
PVC stickup above ground	2.67
3- Wellhead protection / surface casing type	6-inch ID steel casing with lockable watertight seal
4- Dia./type of well casing	2-inch Schedule 40 PVC
5- Type/slot size of screen	2-inch Schedule 40 PVC 0.010-inch (10 slot) factory-milled slots
6- Type screen filter	#10 - 20 colorado silica sand
a) Quantity used	4 - 50# bags
7- Upper annular seal type	3/8-inch bentonite chips
a) Quantity used	28 - 50# bags


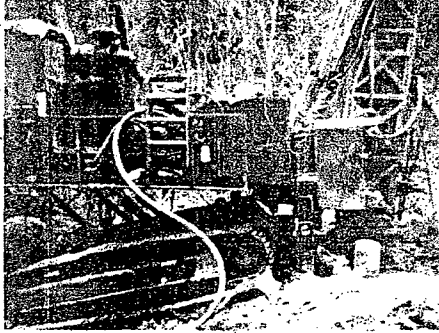



Generalized geology:

0 - 34	Unconsolidated alluvial soils
34 - 142	Revelt Formation quartzite
75 - 80	Possible fractures, cuttings wet
136 - 138	Lithology color change from gray to light brown, some clays evident and coarser cuttings, possible large fracture zone.
	Water production 3 - 4 gpm

Comments

Appendix B

Photographs

	<p>Drilling rig set up. View of piezometer WF-1B location</p>
	<p>Typical drilling rig set up. View of rig set up on piezometer WF-2A</p>
	<p>Typical work area set up. View of work area on piezometer WF-2A</p>
	<p>PVC well casing stickup prior to welding of additional 6-inch steel pipe onto steel casing. Steel casing was drilled and driven into borehole to stabilize upper borehole walls. View of piezometer WF-2B.</p>
	<p>Surface well completions. View of piezometers MF-2A and MF-2B. Measurement of vertical difference between top of steel casing shown in picture.</p>